Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 212)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = x^5 + 2x^4 - 10x^2 - 5x + 4$$
$$q(x) = 8x^5 - 2x^4 - 3x^3 - 4x - 10$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (1)x^5 + (2)x^4 + (0)x^3 + (-10)x^2 + (-5)x^1 + (4)x^0 \\
q(x) &= (8)x^5 + (-2)x^4 + (-3)x^3 + (0)x^2 + (-4)x^1 + (-10)x^0 \\
q(x) - p(x) &= (7)x^5 + (-4)x^4 + (-3)x^3 + (10)x^2 + (1)x^1 + (-14)x^0 \\
q(x) - p(x) &= 7x^5 - 4x^4 - 3x^3 + 10x^2 + x - 14
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 4x^2 - 5x + 3$$
$$b(x) = -5x - 7$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$4x^2$	$-5x$	3
$-5x$	$-20x^3$	$25x^2$	$-15x$
-7	$-28x^2$	$35x$	-21

$$a(x) \cdot b(x) = -20x^3 + 25x^2 - 28x^2 - 15x + 35x - 21$$

Combine like terms.

$$a(x) \cdot b(x) = -20x^3 - 3x^2 + 20x - 21$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 4x^3 + 19x^2 - 6x + 1 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 4 & 19 & -6 & 1 \\ -5 & & -20 & 5 & 5 \\ \hline & 4 & -1 & -1 & 6 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 4x^2 - x - 1 + \frac{6}{x+5}$$

In other words, $h(x) = 4x^2 - x - 1$ and the remainder is $R = 6$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 4x^3 + 19x^2 - 6x + 1$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (4)\cdot(-5)^3 \ + \ (19)\cdot(-5)^2 \ + \ (-6)\cdot(-5) \ + \ (1) \\ &= (4)\cdot(-125) \ + \ (19)\cdot(25) \ + \ (-6)\cdot(-5) \ + \ (1) \\ &= (-500) \ + \ (475) \ + \ (30) \ + \ (1) \\ &= 6 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x+5$. Thus, $f(-5) = 6$.